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Hence the area of the required triangle is

$$\frac{\Delta abc [l(m'n'' - m''n') + m(n'l'' - l'n'') + n(l'm'' - l''m')]^2}{ABC}$$

Also solved by the Proposer.

315. Proposed by ROBERT E. MORITZ, Ph. D., University of Washington.

Given the area of the segment of a circle of given radius to find the length of the chord.

Solution by G. B. M., ZERR, A. M., Ph. D., 4243 Girard Avenue, Philadelphia, Pa.

I. Let r =radius and $2x$ =the length of the chord. Also let A =arc of segment. Then

$$\frac{4}{3}x[r - \sqrt{(r^2 - x^2)}] + \frac{[r - \sqrt{(r^2 - x^2)}]^3}{4x} = A.$$

$$\therefore 169x^5 + 192r^2x^3 - 168Arx^2 + 144(A^2 - r^4)x - 288Ar^3 = 0.$$

If A and r are known, x can be found.

II. Let θ =angle of segment at center of circle. Then

$$\frac{1}{2}r^2(\theta - \sin\theta) = A, \quad x = r \sin \frac{1}{2}\theta.$$

By double position θ is found.

$$\text{III. } r^2[\sin^{-1}\frac{x}{r} - \frac{x}{r^2}\sqrt{(r^2 - x^2)}] = A. \quad \text{Let } \frac{x}{r} = z.$$

$$\therefore r^2[\sin^{-1}z - z\sqrt{(1-z^2)}] = A.$$

$$\therefore \frac{3}{3}z^3 + \frac{1}{5}z^5 + \frac{3}{28}z^7 + \frac{5}{12}z^9 + \dots = A/r^2.$$

By reversion of series z is found, then $x = rz$.

316. Proposed by J. STEWART GIBSON, Department of Physics, Wadleigh High School, New York City.

Determine the locus of the vertices of parabolas described by particles thrown off from the circumference of a uniformly revolving wheel.

I. Solution by the PROPOSER.

Let r =radius of circle, a =velocity of its periphery, ϕ =angular position of particle b at moment of projection, a_v =vertical component of initial velocity, and a_h =horizontal component of initial velocity. Then $a_v = a \cos \phi$. The height, y_1 , to which the particle will rise is (since $h = v^2/2g$),

$$y_1 = r \sin \phi + \frac{a^2 \cos^2 \phi}{2g}. \quad (1)$$